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THE VETERINARY RECORD.

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Royal Counties' Vety. Medical Association, Southern Counties' Veterinary Society, South-Eastern Veterinary Association.

A COMBINED MEETING of the three Societies will be held on Thursday, Sept. 2nd, at the Midland Grand Hotel, St. Pancras Station, London, at 10.30 a.m. Papers by Mr. J. R. Hayhurst on "Definition of the duties of a Veterinary Meat Inspector," and by Mr. J. W. McIntosh on "Some Clinical Observations on Lameness." At 2.15 p.m., practical demonstrations in connection with the papers at the Metropolitan Cattle Market, Islington, N. A dinner will be held at the Midland Grand Hotel at 6 p.m.

Midland Counties' V.M.A.

A Meeting will be held at Mr. Malcolm's, Holliday Street Wharf, Birmingham, on Wednesday, August 25th, at two p.m. The President, R. R. H. Over, Esq., will occupy the chair. Agenda—Routine business; Delegates' Report of The R.S.I. Congress; Professor Brayley Reynolds, R.V.C., London, will read a paper and give a practical demonstration on the treatment of "Quittor."

The President will be glad if members will bring to the Meeting any interesting post-mortem specimens.

Tea at the Grand Hotel at 5 o'clock.

Camden House, West Bromwich. H. J. DAWES, Hon. Sec.

Western Counties' V.M.A.

A garden meeting will be held at "Penwellyn,' St. Columb, Cornwall, on Wednesday, August 25th by kind invitation of the President, F. T. Harvey, Esq, F.R.C.V.S. Agenda—General Business; Morbid Specimens; New National Edinburgh Meeting; Discussion introduced by the President; The Auroscope; The Stomach Tube: Demonstrations on the Horse. All Veterinary Surgeons cordially invited, accompanied by a lady where possible. Luncheon 1 p.m. Meeting 2.30 p.m. promptly.

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THE VETERINARY RECORD

A Weekly Journal for the Profession.

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S.

No. 1676. AUGUST 21, 1920. VOL. XXXIII.

SUPPLY AND DEMAND.

Now that the question of a five years' curriculum for our diploma has been seriously raised, it is well that members should recall the main principle which has guided the R.C.V.S. in making similar decisions in the past. It is based upon the broad conception that the profession exists solely to be useful to the nation, and that the function of the R.C.V.S. is to develope that national utility to its maximum. Under that conception, it is the duty of our Council to supply a sufficient—but not an excessive number of adequately trained veterinary surgeons to the nation. The training of these veterinary surgeons should be kept as high as possible, provided always that entry to the profession is not thereby rendered so difficult as to bring the supply of new graduates below the national demand for them. This condition should not be lost sight of.

Any substantial increase in the time and cost of the curriculum inevitably reduces the number of new students entering the schools. Obviously, therefore, such increases should not be attempted at times when the supply of new students and young graduates already falls short of the National demand; but rather when the profession is becoming crowded. Then the increase confers the double benefit of checking overcrowding and improving the calibre of the graduates. That happened in 1893. The sorely-needed four years' course was instituted when the profession was becoming overstocked with young graduates.

This plan of procedure is not universally accepted, and certain critics are wont to speak contemptuously of it; but it is noticeable that these opponents confine themselves to brief and slighting references, and avoid close consideration of the subject. Few will deny the desirability of a five years' course, but all recognise that its institution presents difficulties; and one of them is the effect it would have upon our numbers.

THE ROYAL SANITARY INSTITUTE.

The next Congress will be held at Folkestone towards the end of June, 1921, by invitation of the Mayor and Corporation.

E. WHITE WALLIS, Secretary.

Capt. A. Adrian Jones, M.V.O., late R.A.V.C., whose sculpture is well known—notably his fine equestrian group on the archway at Hyde Park Corner—has recently completed a virile painting of Field-Marshal Haig on horseback directing operations at the Front.

THE OPEN FORMS OF TUBERCULOSIS IN THE DOMESTIC CARNIVORA.

Prof. G. Petit recently made a communication upon this subject to the Academy of Medicine. In view of the great facility with which human tuberculosis is transmitted to the dog and cat, a transmission from these animals to man must be admitted and feared, especially as they live in close intimacy with mankind, and no precautions against infection from them are generally taken. The danger is especially from open and ulcerous forms of tuberculosis, which are frequent in the domestic carnivora. Petit divides these cases into four main classes, as follows:—

Ulcerous tuberculosis of the intestine, with mesenteric adenopathy and intestinal lesions. In 1916, Prof. Landouzy insisted upon the importance of infection by the digestive canal in dogs, and said: "Enquiries made upon the origin of dogs treated and examined post-mortem for tuberculosis at the veterinary school showed that the very great majority of these animals came from taverns, cafés, etc., where the frequenters cough and expectorate carelessly, and the alimentary *débris* on the floor are thus mixed with sputa, and ingested by the dogs."

Pulmonary caverns, opening into the bronchi. When coughing, the dogs project mucus charged with tubercle bacilli copiously around them upon furniture and garments.

Ulcerous tuberculosis of the skin. These are ulcerous lesions of the face and neck, refractory to cicatrisation, and yielding a permanent discharge of pus teeming with tubercle bacilli. They must not be confounded with "pseudo-cancroids" of the lip in the cat.

Petit also mentions *bacillary pyelo-nephritis*, but adds that cases of this are exceptional.—(*Journal de Méd. Vét. et de Zootechnie*).

W.R.C.

An extremely able, interesting, and instructive booklet dealing with results accruing from pig-feeding experiments in the years 1917–1920 has just been issued by the University of Cambridge School of Agriculture and Institute of Animal Nutrition. No up-to-date farmer interested in pigs should neglect to acquaint himself with the important facts which are here set forth with much lucidity. The lucubration is not confined to the mere recording of results, but contains also excellent passages on the general conclusions to be drawn therefrom.—*N.B.A.*

NATIONAL VETERINARY MEDICAL ASSOCIATION OF GREAT BRITAIN AND IRELAND.

The Thirty-seventh Annual Meeting was held ia Edinburgh, July 28th and 29th.

Dr. O. Charnock Bradley, President, in the chair.

Supported by the officers of the Association, Sir Stewart Stockman, General Blenkinsop, Messrs. Joseph Abson, D.S.O., Sheffield; R. G. Anderson, Cupar, Fife; W. Anderson, Pittenweem, Fife; J. Aitken, Dalkeith; Wm. Brown, Aberdeen; D. Brown, Kilwinning; R. Beattie, Crieff; H. J. Bourne, Falkirk; Hugh Begg, Hamilton; Allan Blue, Glasgow; James Bishop, Perth; J. B. Buxton, London; J. W. Brittlebank, Manchester; John Brown, Invergordon; Archie Baird, Edinburgh; Wm. Bannatyne, Haddington; J. Wright Conchie, Kidderminster; D. Clark, Stonehaven; John Cameron, Berwick; D. Campbell, Rutherglen; W. Cattell, Inverness; R. H. Connochie, St. Boswells; T. D. Connochie, Galashiels; W. D. Connochie, Galashiels; J. Clarkson, Garforth; Dr. R. Crabb, Strichen; A. Douglas, Ayr; Capt. J. J. Dunlop, R.A.V.C.; G.W. Davidson, Wetherby; Geo. Elphick, Corbridge-on-Tyne; Archd. Edgar, Whithorn, Prof. J. T. Edwards, London; Jas. Edgar, Edinburgh; A. B. Forsyth, Cannock; W. G. Forbes, Kilmarnock; W. M. Ferguson, Dundee; A. Gofton, Edinburgh; Prof. J. R. Greig, Edinburgh; Frank Garnett, Windermere; H. W. Good, Scarborough; George Gair, Conon Bridge; John Gibson, Dundee; F. L. Gooch, Stamford; Tom. Grahame, Edinburgh; George Howie, Alford, Aberdeenshire; J. F. Healy, Midleton, Cork; F. T. Harvey, St. Columb; Wm. Hepburn, Aberdeen; G. A. M. Harle, Coldstream; Geo. C. Hill, Glasgow; F. Hobday, London; James Henderson, Edinburgh; T. M. Inglis, Forfar; Prof. David Imrie, Glasgow; Howard I. Jones, Edinburgh; Richard Jones, Towyn; Walter Jowett, Edinburgh; Adam Kerr, Ellon; L. W. Wynn Lloyd, Carnarvon; James Lindsay, Dumfries; James Laird, Kilmarnock; W.W. Lang, Brigg; G. H. Locke, Manchester; J. S. Lloyd, Sheffield; Prof. Linton, Edinburgh; Lt.-Col. A. W. Mason, Leeds; N. H. Macalister, Kirkcudbright; Wm. Manshall, Aberdeen; Geo. M. Mitchell, Sunderland; Prof. Wm. Mitchell, Edinburgh; Hugh A. MacCormack, London; John Macfarlane, Doune; J. H. Mason, Glasgow; Robert Mitchell, Glasgow; James Macfarlane, Glasgow; J. Malcolm, Birmingham; Prof. D. C. Matheson, Edinburgh; A. Mackenzie, St. Andrews: Prof. John McCall, Glasgow; J. A. McClintock, Donegal; J. G. McGregor, Hamilton; Wm. Miller, Edinburgh; David E. Orr, Glasgow; Prof. O'Connor, Dublin; J. Donaldson Pottie, Greenock; A. W. Noel Pillers, Liverpool; W. S. Petrie, Sheffield; W. W. Peggie, Biggar; H. W. Robson, Laurencekirk; Chas. Roberts, Tunbridge Wells; Martin Robinson, Barnsley; W. D. Rees, Trealaw; Wm. Roy, Glasgow; Prof. E. Brayley Reynolds, London; A. Renfrew, Broadway, Worcestershire; S. E. Sampson, Sheffield; Fred. Sanderson, Darlington: And. Spruell, jnr., Dundee; E. H. Stent, Manchester; R. Simpson, Dunbar; J. J. M. Soutar; Lt.-Col. C. F. Stratton, R.A.V.C.; G. R. Simpson, Driffield; J. Taylor, Edinburgh; Capt. E. G. Turner, Redford Bks., Edinburgh; Peter Wilson, Lanark; E. C. Winter, Limerick; Geo. W. Weir, Glasgow; W. Watt, Wishaw; Arthur Weighton, Hull; R. Watts, Stalybridge; W. Jackson Young, Edinburgh.

Visitors present:—A. T. Cameron, R. K. Cameron, Walter Jowett, William Miller, Dr. R. Stewart McDougall, Baillie Richardson, Baillie White, R. Smith, Alan W. Ritchie, Edinburgh.

Ladies present:—Mrs. Brown, Kilwinning; Mrs. H. Begg, Hamilton; Mrs. J. B. Buxton, London; Mrs. A. Baird, Edinburgh; Mrs. Wright Conchie, Kidderminster; Miss F. L. Gooch, Stamford; Mrs. T. Grahame, Edinburgh; Mrs. J. F. Healy, Midleton, Cork; Mrs. G. H. Locke, Manchester; Miss C. Lesie, Birmingham; Mrs. Linton, Edinburgh; Mrs. J. Malcolm, Birmingham; Prof. Miss O'Connor, Dublin; Mrs. Pottie, Greenock; Mrs. C. Roberts, Tunbridge Wells; Mrs. Renfrew, Broadway, Worcestershire. And a number of others whose names unfortunately were not obtained.

BACTERIAL CONTAMINATION OF MILK.

By A. Gofton, F.R.C.V.S.

Presented at the Annual meeting at Edinburgh, July 28th, 29th, and 30th, 1920.

The subject of the bacterial contamination of milk offers such a wide field for discussion that it is essential to restrict its scope if this paper is to be kept within reasonable limits. Comment on various matters has therefore been deliberately omitted, and in respect of others it has been necessarily restricted. In selecting the subject of this paper, your committee had in view the general bacterial contamination of milk rather than its infection with the germs of specific disease, the discussion of which alone would provide ample material for a paper. For this reason only the merest reference is made to the milk-borne infections, with the single exception of tuberculosis, which has been singled out because of its paramount importance and because it is so intimately associated with the question of clean, wholesome milk.

It is generally accepted that milk is a sterile fluid in the deeper parts of a sound, healthy udder. It has been demonstrated that milk can be collected direct from the udder in a germ-free condition, but the precautions necessary for its sterile collection remove the procedure outside the region of practical commercial possibilities. Further, various types of bacteria have been so consistently demonstrated in the teat canal and in the larger ducts of the healthy gland that their presence there must be regarded as a normal phenomenon. It is clear, therefore, that the most elaborate precautions compatible with normal working conditions will fail to exclude the entrance of milk-organisms into milk.

The nutrient properties of milk provide the majority of micro-organisms which most readily gain access to it with the nourishment necessary for life and growth. Multiplication takes place with a rapidity in direct proportion as the conditions under which it is kept are favourable or otherwise. Given appropriate conditions, an original small bacterial contamination may be multiplied manifold in the course of a few hours. Transport conditions provide opportunities for additional contamination and multiplication, and add to the total bacterial content of milk. It is possible, therefore, at this stage to state in general terms that the bacterial content of milk can only be limited by the exclusion, as far as practical, of miero-organisms at the time of collection and during transport, and the retention of milk under conditions which are not favourable to the multiplication of bacteria. The opposite conditions inevitably result in milk showing a high bacterial content by the time it reaches the consumer.

The vast majority of the bacteria found in milk are harmless to the adult consumer, but this statement requires a measure of reserve when applied to infants, whose delicate digestive organs are more susceptible to adverse influences. The carelessness and indifference which multiply opportunities for contamination with harmless bacteria also increase the risks of the entrance of harmful pathogenic organisms which sometimes find their way into milk, notwithstanding careful and intelligent supervision. The grosser changes resulting from bacterial growth in milk are well known, but informa-

tion as to the influence on its finer chemical, physical, and nutritional properties, and on its digestibility is conspicuously defective. It is neither wise nor safe to assume that the latter are negligible, but if, for the moment, the assumption be made, the deterioration and unmarketability of milk consequent on the more obvious changes, and the resulting loss, especially in summer-time, remain, and constitute a material economic consideration. Whilst, therefore, the bacterial contamination of milk demands serious consideration from a public health point of view, it has also an economic insignifi cance for producers and distributors greater than they have hitherto been disposed to accord to it.

Sources of Contamination.

Multiple opportunities occur for the entrance of bacteria into milk before it reaches the consumer, as well as after it is placed in his hands. Much of the contamination which takes place on the premises of producers and middlemen is attributable to lack of knowledge, and consequent inability to appreciate the various factors which contribute to bacterial contamination. As a consequence, inquiry into detail seldom fails to reveal errors of an obvious and elementary character.

It is beyond doubt that the most material contamination of milk occurs on the farm during the process of collection and handling ; but difference of opinion legitimately exists as to the relative importance of the different contributing factors. In Great Britain the greatest weight has always been attached to the cow, and to the general conditions of her surroundings, but some of the tests which have been designed to demonstrate the part which these factors play have thrown little light on the question. The number of colonies developing on agar plates exposed in a byre, or under the udder of a cow during the process of milking, are not tests of the extent to which milk is contaminated from these sources, nor is the number of bacteria in milk immediately after milking evidence of the part played by the cow, unless other obvious contributing factors are excluded. Much greater attention has been devoted to the question in America, and many elaborate and careful tests have been carried out for the purpose of assessing the significance of each article and procedure in the collection of milk. Much useful information capable of practical application has, in consequence, been gained. It has been possible to show that some factors have an importance greater than others ; but the cumulative evidence merely serves to emphasise the fact that the clean collection of milk cannot be accomplished by attention to one or more factors, but is dependent on careful supervision of every detail in the processes of collection and handling.

It has already been stated that bacteria are present with great constancy in the teat canal and the larger ducts of the milk gland. The retention of a small quantity of milk in the teat canal favours the extension upwards by growth of bacteria into the milk sinus, and in all probability this fact provides the explanation for the practice of rejecting the fore milk universally recommended by clean milk advocates. Bacteria are present in small numbers in milk as drawn from the gland under natural working conditions at all stages of milking, but there is a general consensus of opinion that they are present in greater numbers in the fore milk than at later stages.

The skin of the udder, teats, and flanks of the cow contributes its share to the total bacterial contamination. It is much too common an experience to find milk collected from an udder soiled and often wet with excreta. Under such conditions it is impossible to avoid the introduction of manure into the milk, and with it many bacteria. The most pronounced type of neglect in this respect fortunately does not constitute an average condition, but the attention ordinarily paid to cleansing the udder immediately prior to milking is totally inadequate, or altogether in default. In addition, general grooming and especially the cleaning of the flanks and quarters, is usually a perfunctory process. As a consequence more or less accumulation of manure and other dirt, scales, and secretions on the skin is inevitable. These contribute in no mean measure to bacterial pollution.

The farmer objects to washing the udders of his cows owing to the labour and time entailed, as well as for other reasons. If his objections were in reality sound, he at least has no room for taking exception to the moist cloth for wiping the udder and teats, which makes demands on neither labour nor time, but which is not accorded the place to which it is entitled. The value of both washing and wiping depends not only on their cleansing effects, but by damping the skin of the udder they diminish the extent to which detached or loose hairs, scales, etc., fall into the milk. Clipping of the udders, which is advocated as a means of limiting bacterial contamination from the skin of the gland, would appear to operate mainly by preventing accumulations of dirt and facilitating cleansing. The relationship of grooming to milking exercises an influence on the number of bacteria which gain entrance to milk. Observations make it clear that grooming immediately, or shortly before, milking is always associated with higher bacterial contamination.

The personal habits of milkers, and the methods adopted by them, are factors for good or ill. Hands are too seldom washed before commencing to milk, and very rarely during the process of milking. In the average byre, soap and water for hand washing are rarely seen. The same clothing serves the purpose for all the various kinds of farm work, and overalls for wear during milking, which ought to form part of the equipment of all dairy workers, are mostly conspicuous by their absence. Wet milking compares very unfavourably with dry milking in respect to bacterial pollution. Pig feeding in association with milking is particularly objectionable, unless the two kinds of stock are adequately separated so far as housing and workers are concerned. The same workers very commonly attend to both cows and pigs, and although excellent results may be achieved by the exercise of intelligent care, the precautions taken are frequently inadequate, and milk from these sources too often shows a higher degree of bacterial pollution than is consistent with a proper regard for cleanliness.

The influence of the personal factor has many times been put to the test, and it has been clearly demonstrated that the worker trained in the methods of clean milk collection, who has been taught and has appreciated the significance of the various adverse factors, and who has learnt how to eliminate or to minimise them, will produce infinitely better results than the untrained worker under the same conditions.

Opinions differ as to the influence exercised by the construction and general arrangement of dairy byres on the clean collection of milk. A well-constructed and well-arranged byre lessens labour all round, and facilitates the maintenance of cleanliness, but given proper methods the most excellent results can be achieved under conditions the reverse of promising. The proximity of manure pits, with the consequent plague of flies in summer-time, are avoidable sources of contamination. Lofts over cows, and disturbances caused by feeding and bedding increase the dust of the atmosphere, and the latter should be avoided immediately prior to milking. The practice of standing wide-mouthed containers in the passage ways of byres during milking facilitates the entrance of dust and other forms of contamination, and should be discouraged.

The equipment and utensils employed in the collection of milk are amongst the largest and most important contributors of bacteria. Very frequently they provide

the explanation of a heavy bacterial contamination of milk from premises well equipped, clean, and to all appearances well managed and well run. Conversely, the care bestowed on them is just as often the explanation of a much cleaner milk collected under adverse byre conditions. The errors discovered are often almost absurd in their simplicity. It is not uncommon to find wiping-cloths and brushes used day after day for utensils, and remaining innocent of hot water or steam; remnants of milk left in inequalities, corners, or crevices of containers, where they serve as breeding-grounds for bacteria, and are carried from milking to milking; coolers inefficiently cleaned, constantly exposed between milkings, and used without thought of rinsing.

Sterile utensils would be ideal if they were practicable. Live steam provides the means of approaching most nearly to this ideal, and is always a valuable adjunct to the efficient cleansing of containers. It is highly desirable that it should be available in all dairy byres, but even in its absence, if due care is observed, results can be obtained which will stand comparison with those encountered on premises where steam is laid on, but detailed supervision and care are not exercised. Churns and cans should be dried after cleaning, and kept inverted when not in use.

Small top milk pails limit contamination from the cow and the atmosphere of the byre. The average farmer, however, takes exception to them on the ground that they are a source of inconvenience to his workers. This sentiment would perhaps be more correctly described as prejudice, for it is the experience of those who have used them that any awkwardness experienced is overcome in the course of a few days.

Milking machines appear to offer advantages over hand milking by excluding almost wholly contamination from the cow and the worker. In practice, these apparent advantages are often more than counterbalanced by inefficient cleansing of tubes and cups. In this respect, milking machines always present a difficulty which is added to by the perishable rubber of which they are in part composed.

Briefly summarising—Methods and equipment are the all-important factors determining the extent of bacterial contamination on the farm. The surrounding conditions are less material than attention to each detail in the methods followed. Fine buildings and expensive equipment may possess undeniable advantages, but they add to the cost of production, and neither is essential.

The clean collection of milk demands neither highly-specialised knowledge nor highly-trained skill. The knowledge of basal facts, combined with ordinary intelligence reasonably applied, and consideration of detail, which quickly develops into routine without undue increase in labour, are capable of accomplishing more than the average producer appreciates.

A distinct and obvious lack of appreciation exists of the opportunites which are provided for the bacterial contamination of milk in railway stations, sidings, and on the streets during the process of delivery. Consumers are equally unappreciative of the extent to which they contribute to deterioration and early souring of milk after it is placed in their hands.

Cooling imposes a first check on bacterial growth, and if milk can be retained at a temperature between 45° and 50° F., multiplication is nearly negligible. On the farms cooling is effected by means of well or tap water. As a consequence, it is most efficient in winter time when the need is least, and the prevailing weather conditions are not favourable to rapid bacterial proliferation. In summer, on the other hand, cooling on the farm is less efficient, and, with existing transport conditions, long-distance milk suffers from the high temperature to which it is exposed. If long-distance milk is to be assured of reaching its destination without the risk of becoming stale or sour in summer, refrigerating vans for its transport are a necessity. In America, Denmark, and other continental countries, the value of retaining milk at low temperatures during transport in order to preserve its keeping properties by limiting bacterial growth has long been recognised. The experience of these countries is convincing evidence that the retention of milk at a low temperature throughout all stages between the cow and the consumer constitutes a most valuable contribution to raising the general hygienic standard of milk.

In many towns the demand exists for warm milk, and much of the milk produced in the immediate neighbourhood is delivered without cooling, and within an hour or two of collection. In respect that time limits the opportunities for bacterial multiplication before delivery, such milk secures a distinct advantage over that coming from long distances, especially if it is for early consumption, but the advantage is sometimes more apparent than real and is lost by careless handling or in its passage through the hands of middlemen. Its keeping properties suffer from the neglect of preliminary cooling; and should it have been collected under unclean or careless conditions, early deterioration and souring are just as inevitable as in the case of long-distance milk. In all large towns no difficulty would be experienced in finding a sample of local milk which, five or six hours after collection, compared unfavourably with milk twenty-four hours old drawn from a distance. The reverse, however, is equally true.

The indifference of the average consumer to the contamination of milk is manifest before purchase as well as after, and is due less to carelessness and more to a lack of knowledge of the factors which operate adversely on its properties and keeping qualities. The errors of the consumer in storing milk after it is placed in his hands will not be discussed here; suffice it to say that, for the most part, he possesses a minimum of knowledge and exhibits a maximum of indifference to the conditions under which milk is produced, and under which it ought to be retained if its best qualities are to be preserved.

Nature of Bacterial Contamination.

The great majority of bacteria found in milk are saprophytic in habit. They represent a great many types, over one hundred and fifty of which have been described. So much confusion has arisen in regard to nomenclature, and more particularly in respect of the means of accurate differentiation, that an attempt to draw up a list even of the more common varieties would scarcely repay the labour entailed. The predominant forms are responsible for the "natural" souring of milk, and they are commonly grouped under the term "Lactic Acid Bacteria." This grouping is more convenient than correct, since organisms are usually included which play a part in the souring of milk, but which are not capable of producing lactic acid from milk sugar.

Heineman and Kruse (1) considered that the various organisms represented could be conveniently divided into two groups, namely, those belonging to the Streptococcus lacticus group, and those belonging to the Bacillus coli group, both being constantly present in raw milk. The former generally predominate, since they multiply more rapidly at temperatures at which the coli group grows slowly or not at all. Both types usually increase in numbers with the age of milk until increasing acidity and diminution of food supply inhibit further growth. Putrefactive organisms then quickly predominate, but milk will have become quite unmarketable long before this stage is reached.

Although the streptococcus lacticus is an important factor in bringing about early souring and deterioration

(1) Heineman—Milk.

of milk, it is nevertheless an ally essential to the farmer in the manufacture of butter and cheese. The streptococcus lacticus and the more closely allied members of the group play a vital role in the changes by which these dairy products are obtained, and they also contribute materially to the qualities of odour and taste. The influence of the coli group, on the other hand, is adverse in its tendency to bring about depreciation in both respects. The vital necessity of the former in certain dairy processes does not, however, modify the desirability of its exclusion, as far as practicable, during the collection and handling of milk, for both groups co-exist in nature, and are ubiquitous in their distribution in and about dairy premises. Further, they are always in association with other bacteria and moulds which, whether pathogenic or not, contribute their share to the depreciation of milk and its by-products. This view is strengthened by the facts that science has provided the farmer with substitutes in the form of "starters," by means of which the naturally acquired bacteria can be reinforced, and that the pathogenic properties liable to be acquired by milk as a consequence of careless supervision and handling are well known in many cases to be continuous in the products derived from it. The so-called "cow-smell" which is associated with milk collected under unclean conditions, is the result of the presence of bacteria in it.

The coliform organisms, from whatever source derived, represent a group whose presence in milk is most undesirable. They are always attributable to questionable sources, and some of them possess undoubted pathogenic properties. So far as I am aware, no definite causal relationship has been established between the coliform organisms ordinarily encountered in milk and infantile diarrhœa, but, until precise information is forthcoming, milk in which the coli group are well represented will rightly retain the suspicion at present attached to it.

The causal organisms of mastitis are commonly present in market milk. Few herds can claim to be completely free from this disease at any given time. In the more acute forms, the pronounced changes in the milk lead to its consistent rejection, but the sub-acute type is very prevalent, and the alteration in appearance of the secretion immediately after withdrawal from the gland is so slight that the average dairyman fails to recognise it, and the milk is passed into the general supply. The changes in the milk, however, are very manifest if it is allowed to stand for a very short time, and it always teems with the causal streptococcus. The proof that this organism exercises the definite pathogenic effects on the consumer which have often been attributed to it is far from conclusive, but no room for question exists that it is a most undesirable addition to milk, and that it contributes in an important degree to the changes which bring about early deterioration.

The most significant feature of bacteria in milk is the fact of pathogenicity or non-pathogenicity. A small number of pathogenic organisms outweigh in importance millions of non-pathogenic. The determination of pathogenicity, however, requires time, and is not called for as a routine procedure owing to the relative rarity of the majority of specific infections (scarlet fever, diphtheria, typhoid, etc.), which it is known may be communicated by milk. In any case, the evidence of their presence will be clinically manifest earlier in the majority of cases than could be demonstrated in the laboratory. Exception to this general statement must be made in the case of tuberculosis, which is by far the most common and the most important of the infections spread by milk. In contrast with those referred to, the clinical evidence of its presence is only manifested after the lapse of an indefinite and sometimes prolonged period of time.

Amongst the pathogenic organisms encountered in retailed milk, the tubercle bacillus constitutes the most real and material danger. Its origin is, for the most part, the milk gland in which the disease has obtained a location, but it is also clear that in certain advanced and generalised cases of tuberculosis in cattle, tubercle bacilli are discharged in the milk in the absence of lesions in the milk gland. Further, it has been clearly demonstrated that the fæces of cows which are the subjects of extensive pulmonary tuberculosis, contain living virulent tubercle bacilli. The carelessness which permits manurial pollution thus provides another channel whereby these dangerous micro-organisms may gain entrance to the milk.

Extent of Bacterial Contamination.

Various methods are employed for estimating the extent of bacterial contamination in market milk. Briefly, they are as follows :—

(a) Plating and cultivation on agar for forty-eight hours at 37° C. ; (b) Plating and cultivation on gelatine for four to six days at room temperature ; (c) Direct microscopic examanination of stained centrifugalised deposit.

In (a) and (b) the colonies which develop are counted, and an estimate of the total number of bacteria present is formed by assuming that each colony has arisen from a single bacterium. Whichever method is followed, the result obtained is no more than it is claimed to be—an estimate—but the value of the procedure is not nullified by the failure to achieve accuracy. On the contrary, it supplies information which is capable of the most useful administrative application.

Conclusions as to the extent of bacterial contamination have sometimes been based on the amount of insoluble sediment in milk. This procedure is open to so many obvious objections, not the least of which is its failure to take account of multiplication, that no value can be attached to it as a guide to the extent of bacterial pollution.

In the U.S.A., the estimated number of bacteria present in market milk has been much used during the last eight or ten years as one of the main guiding factors for the purpose of grading and classification. The New York standard, chosen as being fairly representative, is quoted in order to provide a basis for comparison when referring to the extent to which the milk in this country is contaminated.

New York Standard (1).

Grade A, Raw	bact. per c.c.	Milk	60,000
„ „	„	Cream	300,000
Grade A—Before Past.	„		200,000
„ Pasteurised	„	Milk	30,000
	„	Cream	150,000
Grade B—Before Past.	„		1,500,000
„ Pasteurised	„	Milk	100,000
	„	Cream	500,000
Grade C „	„	Milk	300,000
(Sold for cooking and manufacturing only.)		Cream	1,500,000

It is convenient at this point to refer to the position in this country in relation to bacterial standards for milk. In the month of March the British Ministry of Food instituted a bacterial standard for milk in connection with its scheme of licensing, permitting the use of term "Grade A (Certified) Milk." One of the conditions attached to the right to use this designation is quoted :—

"The milk, on examination at any time before delivery . . . must not contain B. coli in one-tenth c.c. (in each of two tubes), or more than 30,000 bacteria per c.c."

(1) Heineman—Milk.

In the English Milk and Dairies (Amendment) Bill at present before Parliament. Sect. 2 seeks power to grade milk, and it seems justifiable to assume that the lead given by the Ministry of Food in connection with the use of the term "Certified Milk" provides a forecast of the procedure contemplated by the Ministry of Health in terms of the section.

The Astor Committee (2) on the production and distribution of milk, in its final report, expressed the opinion that almost all the milk sold in English cities if offered for sale in New York would be classified Grade C. Presumably the Committee was justified, on the evidence before it, in forming this opinion, but the facts quoted, though disclosing very unsatisfactory conditions, do not seem to afford sufficient justification for such a sweeping indictment. In two series of samples delivered in Londor, and referred to in the report, the milk would fall to be classified on the New York standards laid down for the various grades before pasteurisation, as follows :—

	Hospitals.	Schools for Mothers.
Grade A, Raw . .	2	...
„ A, Pasteurised .	3	1
„ B, „ .	11	9
„ C . . .	5	18
	21	28

B. coli were present in all samples, and tubercle bacilli in five (10 per cent.). The maximum counts in the first and second series, respectively, were two hundred and fifty million and one hundred and four million bacteria per c.c. It is not stated whether any of the milk had been pasteurised before sampling. Delépine (quoted in the Astor Report) examined thirty samples of milk delivered to Manchester hospitals in 1916 and 1917, and found over 64 per cent. contained bacteria in excess of one million. In Edinburgh six test samples taken at intervals from two different sources on delivery showed the following results :—

No. 1.		No. 2.	
Bact. per c.c.	Coliform bact. per c.c.	Bact. per c.c.	Coliform bact. per c.c.
220,000	—	479,000	—
609,000	1,000	433,500	Absent in 0·1 c.c.
195,000	100	1,884,000	1000

The first two samples from No. 2 source had probably been heated, but definite evidence was not obtainable.

The following figures from Glasgow and Edinburgh give an indication of the degree of contamination encountered at different stages between the cow and the consumer. The figures from the two cities are not comparable with each other, nor with those of London. The Glasgow samples were collected in course of delivery from the farmer to the dairyman ; the Edinburgh samples were taken on the farm, and plated on an average three to four hours later, being retained under conditions which excluded external contamination, but did not inhibit multiplication.

Bact. per c.c. Not exceeding—	Glasgow (3).	Edinburgh.
30,000	3	1
60,000	2	
200,000	5	21
500,000	2	17
1,000,000		9
1–4,000,000		5
Total	12	53

(2) Final Report of (Astor) Committee on Production and Distribution of Milk.

(3) Buchanan—Abstracts from Astor Report.

B. coli were demonstrated in six Glasgow samples, and in twenty-five out of thirty Edinburgh samples. In two of the latter the number present was less than 10 per c.c.

The following table gives an indication of the numbers of coliform organisms present in the twenty-five Edinburgh samples referred to :—

Less than 10 per c.c.	2
Minimum 10 „	14
„ 100 „	5
„ 1000 „	4
Total	25

No definite relationship existed between high coli content and a heavy bacterial count. In certain instances the high count was clearly attributable to heavy initial coli pollution. Further, the samples were all collected during the colder period of the year, when coli multiplication would be at a minimum

The frequency of the presence of tubercle bacilli in mixed market milk shows considerable variations in different districts, and in the same district at different times. In certain instances its presence has been recorded in over 20 per cent. of retailed milk. Delépine (4) examined 8050 samples of market milk, and recorded that 8·7 per cent. contained the living virulent bacillus. This figure is fairly generally accepted as the average extent of infection in mixed milk as sold in towns and cities.

Interpretation and Value of Bacterial Counts

The belief prevails widely that an opinion as to the cleanliness of milk may be based on the estimated numbers of bacteria contained in it, and that the degree of manurial contamination may be measured by the presence and numbers of the coli group. Very little consideration must make it clear that mere numbers do not form a reliable guide. Numbers alone take no account of multiplication, and the temperature at which milk has been retained determines in a very large measure the rate and extent of growth of the bacteria present. A milk, originally clean, exposed to conditions favourable to multiplication may show a much higher bacterial count after a few hours than one originally dirty and possessed of much greater potentialities for harm to the consumer, but which has been retained at a temperature unfavourable to growth. Buttermilk, derived from sources unimpeachable on the score of cleanliness, often contains one thousand million bacteria per c.c.

Excess of numbers in retailed milk indicates that its keeping properties have been impaired, or that it has already become stale, and undergone chemical and physical depreciation. They are evidence that fault or faults exist whose significance and location can only be determined by inquiry into the whole conditions of supply. They direct attention to supplies which require supervision and improvement, and provide a powerful lever with which to secure the elimination of prejudicial influences. They also afford a means by which control can be exercised over the adequacy of the measures adopted for this purpose, as well as on the efficiency of inspection. For these purposes bacterial standards have a very material value. The standards which have so far been laid down have only considered the condition of milk on delivery ; but if the bacteriological examination of milk is to have a real administrative value farm standards become virtually a necessity.

Opinions differ as to the value of bacterial standards for the purpose of grading milk. Such standards would almost inevitably operate unfairly and hardly on long-distance milk, especially in summer-time, until conditions of transport are materially improved. Intelligent and highly successful efforts to exclude contamination on the

(4) Delepine.—Tuberculosis and the Milk Supply. A.V.O.H. Meeting October, 1911.

farm are liable to be nullified by additions and multplication during transport, and such milk, regarded from the point of view of numbers alone, may compare most unfavourably with a short-distance milk to which more fundamental grounds exist for taking exception.

Savage (5) expresses the view—with which the writer is in full agreement—that under existing conditions "it does not seem practicable to set up any bacterial standards, either of the number of bacilli or of the number of any special groups of bacilli, which can serve as a basis for administrative action." . . . "On the other hand, bacterial standards can and should be set up for guidance in administrative work." . . . "Bacterial examination of milk should be worked hand in hand with sanitary inspection."

The view that the coliform organisms provide a measure of the manurial pollution of milk is based on the facts that they are of fæcal origin, and that when found in drinking water they are attributed to contamination with human excreta. Primarily, the coli group of micro-orgagisms may be fæcal in origin, but indirect channels contribute at least as frequently and as heavily to coli contamination of milk as actual pollution with manure. The B. lactis aerogenes is the member of the coli group most commonly and most abundantly encountered in milk. Tests made to determine the relative frequency of its occurrence in milk and in cow fæces have shown that it is found more abundantly in the former than in the latter. On the other hand, it is the member of the group which appears to find the conditions prevailing in milk most favourable to its multiplication. Temperature influences the numbers, since a low temperature inhibits growth. Heineman (1) concludes a full discussion of the significance of B. coli in milk as follows:—

"It is clear that a test for B. coli in milk requires a thorough knowledge of conditions for proper interpretation. It cannot, at the present stage of our knowledge, serve as a measure of manurial pollution, but does indicate that the milk has probably been kept at a temperature high enough to permit growth. And since it appears that B. coli is really of manurial origin, while B. aerogenes comes chiefly from a different source, such tests must remain of doubtful value as long as a rapid method of distinguishing the two types is not known. And, furthermore, while high counts of bacteria of the coli-aerogenes group are due to growth, initial pollution is largely due to poorly cared for vessels in which growth has taken place before the bacteria have entered the milk."

Reduction of Bacteria in Milk.

Sterilisation by exposure to heat, or by high-frequency electric currents, is not carried out to any material extent commercially. The former is almost wholly a domestic procedure, whilst the latter has not emerged from the experimental stage.

Pasteurisation is very largely adopted in large towns, and the temperature in summer, combined with existing transport conditions, makes pasteurisation of much of the long-distance milk an economic necessity. Commercial pasteurisation is a variable quantity, but it consists, for the most part, in heating milk to a temperature of 140° to 150° F. and immediately cooling it. This procedure is not efficient pasteurisation, but it destroys large numbers of bacteria and prolongs the keeping properties of milk without affecting its taste or palatability.

The variations which occur in the procedure and efficiency of commercial pasteurisation led the Astor Committee to urge the need for defining and standardising pasteurisation as applied to milk. Pasteurisation should comprise a procedure which will ensure the destruction of the tubercle bacillus, since, in its capacity for harm, it occupies the place of paramount importance, and it is one of the most resistant micro-organisms encountered in milk. Considerable diversity of opinion exists as to the minimum temperature and time required to accomplish this purpose; but it is quite certain that the ordinary commercial process of heating does not render the tubercle bacillus innocuous. The Dominion (of Canada) Dairy Conference, held at Ottawa in 1918 reached the conclusion that milk must be held at a temperature of 170° F. for at least ten minutes, and that lower temperatures were ineffectual. The predominant note of the discussion which preceded this conclusion appears to have been the protection of pigs against infection with tuberculosis from milk and milk by-products (1).

In this country the evidence shows that a temperature of 145° F. continuously held throughout the volume of milk for a period of thirty minutes can be depended upon to render the tubercle bacillus innocuous, but in America and in Denmark greater faith is attached to a higher temperature for commercial milk, and less faith to its retention at a lower temperature for a longer period of time. The Chicago regulations fix a minimum temperature of 175° F. for thirty seconds, and the Danish law 172° F.

Heating or pasteurisation, no matter how efficient, merely disguises bacterial contamination, and does not constitute a remedy for it. The inevitable consequence of the multiplication of large numbers of bacteria in milk is the modification in some degree of its properties, and neither pasteurisation nor any other process ordinarily employed can reverse the changes which have already taken place. Further, we have no reliable knowledge of the effect of heating on the nutritional properties of milk, and in particular on the availability and activity of the all-important vitamines.

In order to limit bacterial contamination the only sound line of procedure consists in reducing or eliminating the various contributing sources at all stages between the cow and the consumer, in excluding, as far as human care and foresight can accomplish it, the entrance of pathogenic organisms, and in retaining milk at a temperature and under conditions which prevent growth and multiplication. Improvement of transport and of the conditions of delivery are essential corollaries to the latter.

Concluding considerations. Referring to the improvement in the hygienic quality of milk, the report of the Astor Committee makes the following statements:—

"It has become generally recognised that if there is to be a real improvement in the cleanliness and hygienic quality of the milk supply of this country, it is essential to abandon the theory that all milk is of one quality, or that it is possible to raise the whole milk supply rapidly to the highest grade. The public realise that the eradication of disease or the use of more skilled labour to produce cleaner milk necessitates additional cost to the farmer, which he will only, and can only be expected to bear if he gets in return either some official certificate of the better quality of his milk, which will enable him to charge a compensating price, or to receive a higher price under an official system of fixed prices." . . . "Real progress cannot be made without the co-operation of the general body of the community, but in the past they have shown very little knowledge or understanding of the subject." . . . "A system of payment by results, and education of both producers and consumers, so that the one shall produce and the other demand a higher grade of milk, is likely to lead to the most beneficial results."

There can be no disagreement with this expression of opinion so far as it states in general terms the process

(5) Savage—Milk and the Public Health.

(1) Heineman—Milk.

by which improvement in the hygienic standard of milk supplies may be achieved, but the view can scarcely be accepted that the public has realised either that milk is not all of one quality or that the production of clean milk and the eradication of disease from dairy herds entail the outlay of additional labour and money which the producer is entitled to recover in the form of a higher price for his produce. The average consumer can scarcely claim to have given a thought to the cost of producing clean milk or eradicating disease, and consistently uniform prices do not disturb his belief in uniformity of quality.

Producers have been so impressed with the expensive buildings and fittings and the elaborate equipment which, until comparatively recently, were believed to be essential to the best hygienic standards in the collection of milk, that the majority have hesitated to approach the problem with the seriousness it deserves, believing that the capital and running costs entailed would make it prohibitive and unprofitable. For this reason it cannot be made too clear that, whilst buildings and equipment may possess undoubted advantages in many respects, they do not need to be either elaborate or prohibitively expensive.

Sufficient evidence has been accumulated to show that the personal element and the methods adopted are the real determining factors. These entail expenditure of labour and time in the careful conduct and supervision of detail, and they demand knowledge and intelligence in its application. The faithful adherence of the average producer to long established—almost traditional—procedure is evidence that he does not possess the requisite knowledge.

Existing conditions offer little encouragement to dairymen to acquire the requisite knowledge or to make the effort necessary to raise the hygienic standard of milk. The mass of consumers have not yet realised that superior qualities of milk guaranteed free from disease cost more to produce than inferior qualities without the guarantee. Fairness demands that the producer should receive an adequate return on his additional outlay. The degree of willingness on the part of the public to recognise this elemental truth may be measured by the limited demand which exists for the higher grades of milk, and which is confined almost wholly to a small section of the community. Given the willingness to pay, the supplies will keep pace with the demand, but until the producer sees a reasonable promise of realising prices which will leave him with a margin sufficiently satisfactory to compensate him for the extra outlay and effort required, it need occasion no surprise if he remains content to supply the public with just as much as they are prepared to pay for. It is not my desire to minimise the obligations which rest on producers to raise the hygienic standard of milk to the level demanded by modern ideas. On the contrary, they cannot be too strongly emphasised.

Administrative bodies, especially those concerned with public health, are in a position to exercise the most powerful educational influence on both producers and consumers who are naturally prone to measure the value attaching to clean milk, freed from the suspicion of disease, by the actions and attitudes of these bodies. Supplies of milk are essential for the children admitted to hospitals and other public institutions. They are also essential under the child welfare schemes which have been constituted a fundamental part of public health administration. These supplies provide the opportunity of demonstrating in practical form the real value of guaranteed milk, and no better lead could be given to the public.

Guaranteed milk entails additional cost, but the extra expenditure constitutes an almost negligible fraction of the cost of public administration as it affects child life at the present day. Further, by the influence it is capable of exercising for good on the health, nutrition, and general welfare of child life, it represents an investment likely to give the most valuable returns to the community.

The problem of tuberculosis in dairy herds must be faced boldly. Detection of the cow with advanced tuberculosis, or tuberculosis of the udder, and the demonstration of the tubercle bacillus in retailed milk are necessary and useful under existing conditions, but they are not progressive. They approach the problem from the tail-end instead of the head. Permanent and appreciable progress will only be achieved when tuberculosis is tackled in the breeding herds. For the breeder, the problem is a difficult one, and he is too liable to be discouraged when the tuberculin test reveals a high percentage of infection in his stock. He has difficulty in realising that on an outside estimate the position can be completely reversed in the course of four or five years, and he does not appreciate the higher value of the asset which can be secured for a relatively small outlay of labour and money. These facts are only made clear by experience. The experience of dairymen who have cleared their herds of tuberculosis has led them to express the opinion that the procedure had proved one of their best investments.

The value accruing to the general community from reduction of the incidence of tuberculosis in dairy herds is infinitely greater. The mass of evidence which has been accumulated demonstrating the danger to infant life which lurks in milk, leaves no room for doubt on this point. For this reason the principle of affording practical assistance and advice from the public services and out of the public funds to breeders of dairy stock for the purpose of eradicating tuberculosis from their herds merits encouragement and extension.

In conclusion, I wish to express my thanks for the reports on the bacteriological examination of the Edinburgh samples of milk to Mr. W. Jowett, F.R.C.V.S., D.V.H., who carried out the work in Edinburgh Corporation Veterinary Department.

The discussion on Mr. Gofton's paper was preceded by the exhibition of a cinema film showing the handling and bottling of milk kindly lent by the National Clean Milk Society.

At the conclusion of the exhibition, Mr. Gofton moved that a vote of thanks be accorded to the National Clean Milk Society for their kindness in lending the film. This was carried unanimously.

Discussion.

Hugh Begg, F.R.C.V.S., County and District Veterinary Inspector, Lanarkshire.

Mr. Chairman and Gentlemen,—I feel that I owe you an apology for presuming to open the discussion on Mr. Gofton's paper, seeing that we have with us here such a veteran in the campaign of producing pure milk as Mr. Malcolm of Birmingham. However, I have failed to persuade him to lead the debate, and as I promised three months ago to the Provisional Committee either to produce the paper or start the discussion, it is necessary that I should make an attempt.

I think you will agree that we may say without flattery of Mr. Gofton's paper on the "Bacterial Contamination of Milk" that it is worthy alike of the occasion and of his own high reputation. It is what it professes to be, a *resumé* of what is known at this time with regard to the general bacterial contamination of milk, the factors that operate to produce contamination, and the means that are potent to prevent and control it. If he has confined himself rather closely to a consideration of saprophytic as distinguised from specific contamination,

notwithstanding the greater importance of the latter, he has correctly interpreted the Committee's desire, and we have to remember that committees as well as individuals like to be in the fashion, and the present fashion, as you know, has been set by the publication of the Astor Report.

We do not claim in Lanarkshire to have done much more than to prove by the examination of a series of milk samples that the published figures of bacterial counts in milk are reliable, but we can claim that for many years the inspection of every dairy herd in the County has been carried out for the detection primarily of cases of tuberculous mastitis, and that simultaneously we have conducted propaganda for the cleaner production of milk in all its details.

It seems to me that in our keenness to follow this new cult of the contamination of milk with the ordinary organisms of the air it is possible that we may fail to keep in proper perspective the relatively greater importance of the contamination by tubercle bacilli, and I am glad to note that the essayist emphasises the greater significance of the latter. No local authority that has failed to take advantage of the optional powers it possesses for the elimination of the cow suffering from tuberculous mastitis can justify the taking of anything more than an academic interest in the general contamination of milk by saprophytes. Let them qualify to wear the lighter airy habiliment of this new cult which might easily of itself chill the life of their reputation, by donning first the trustworthy undergarment of a campaign against the tuberculous contamination of milk. When we recall the fact that hundreds of thousands of pounds have been spent by Local Authorities in providing hospitals and sanatoria for the treatment of victims of tuberculosis, can it be considered reasonable that they should fail to make the attempt to procure tubercle free milk for the inmates? In too many cases the patients consume raw untested milk from untested cows, while the pigs, in the backyard, have every ounce of their food sterilised so that no pork may be lost. One of the last cows condemned by me last season was valued at £45. She was but two weeks calved, and her daily yield was five gallons. The off fore quarter had the typical feel of vulcanized rubber, yet the milk got from it was as plentiful and as normal-looking as that got from the other quarters. The bacteriologist's report on the sample taken was that a microscopic examination of the smear revealed many tubercle bacilli. Who will estimate the capacity of such a cow to infect the consumer? And when we consider the number of cases of tuberculous mastitis that are detected by making inspection only once a year, does it not seem almost preposterous that we should devote so much time and study to the saprophytic bacterial contamination of milk before we have dealt efficiently with its contamination by tubercle bacilli? I have had too much expcrience of tuberculous mastitis in cows, and all that this disease means to the consumer of milk, to have any patience with the veterinary inspector who would give the general bacterial contamination of milk with saprophytes pride of place. To do so savours of worrying over what the treatment should be for the known chronic lameness of a horse that is about to die of pneumonia through neglect.

We know what many of our chief municipalities have done, and are doing, to protect the health of their populations in this connection, but with the great majority of our local authorities the veterinary inspection of cows is a dead letter. The Tuberculosis Order was a splendid instrument for the speedy removal of the dangerous cow, and I feel sure nothing short of its renewal with compelling powers will move some local authorities to spend money in getting the country cleared of these animals.

We have now for a considerable time been in possession of the knowledge that our most carefully produced milk contains myriads of bacteria of one kind or another, and if it did not, I am afraid we would have to do without butter and cheese. But what does this knowledge signify if no routine inspection is being carried out, and nothing is being done to ensure that the milk cow will be housed better and kept cleaner, that the dairy utensils will have greater attention paid to their condition, and that milkers will be more tidy in their personal habits and more careful in the collection of milk.

Again, I question very much the wisdom of publishing broadcast the fact that ordinary milk contains so very many micro-organisms, for there are many people to whom the slightest hint of peril will set them about exploring the whole circumstances, with disastrous consequences, for their thoughts on bacteria are prone to centre round what they have heard of the power of specific organisms to produce disease.

The work of propaganda in educating the public mind must be carefully considered, lest with an excess of zeal we accomplish an unwarranted reduction in the number of milk consumers. We must not attempt to attain ideals by revolutionary methods and before its day, else we will make more cynical than ever those to whom milk represents a perfect food, whatever its bacterial content. As practical men we must not rush this very healthy baby too soon out of its swaddling clothes. Let its growth be sure and gradual, so that its very robustness will command the homage alike of the idealist, the cynic, and all the intermediate stages of human thought.

When I think of the vastly greater issue, the pathogenicity of the milk yielded by the subject of tuberculous mastitis, the newer cult of attaching great significance to what is known as the general bacterial contamination of milk appeals to me as little more than a phantom whose chief if not its sole significance lies in its power to betray varying degrees of uncleanness in the production and handling of milk.

Bacterial Counts. I will leave to those of you who undertake and carry out the laboratory work entailed in estimating the bacterial content of milk to criticise that part of the paper that deals with description of methods. I would, however, suggest that in view of the evidence we have of the discrepancies that obtain in the results got by different observers, the time is ripe for the standardisation of the methods employed, so that the only influence operating to produce inconstancy in results may be the irremovable one of the personal factor.

Perhaps I might also without presumption suggest to bacteriologists the desirability of classifying and differentiating between the various types of bacteria that are found in milk, so that we may have an intelligent idea of their significance to the consumer. It would also be to the advantage of all concerned if nomenclature could be simplified. To this end, bacteriologists when they have made detailed progress in the study of milk bacteria and tabulated their results should meet in congress, compare notes, and arrange for the baptism of every organism regarding which their results are found to agree.

Mr. Gofton has dealt in detail with the adverse factors met with in milk production and indicated remedial measures, and he summarises by saying that the personal element, methods and equipment are the all-important factors, and I think we will all agree. I have the feeling, however, that he underrates the influence of surroundings, and perhaps does not fully appreciate the conditions that obtain in many country byres. The filthy condition of the udders, buttocks, and tails of the cows in some byres is too appalling to be dismissed as an unimportant factor in the pollution of milk, and the worst of it is that it is almost impossible in practice to keep the animals tidy, owing to the unsuitability of the stalls for their occupants. How seldom is it that

we find any variety in the length of stall in the ordinary byre, yet the animals vary greatly in their requirements if they are to lie down on a bed devoid of excreta. This defect is specially evident in the byres of owners that breed their own cows, and it is usually the case that the milking heifers are grossly polluted in their hind parts because they are too short for the stalls, and their fæces and urine fall not into the dung channel, but on the floor of the stall. Again, how often do we find, especially in byres where intense production is carried on and big cows of best quality are bought, that fifty per cent. of the cows are too long for their stalls, and stand with the hind feet in the dung channel for the greater part of the day. Then when they are asked to get up, their soiled, wet feet foul the bed, and the buttocks, udder and teats cannot escape pollution. The absence of partitions in the stalls of many byres is also a contributing factor to this pollution. And it is remarkable in the case of unclipped cows that are misfits in their stalls, how quickly the hind parts are polluted and matted with excreta, until in some cases, where the hair of the udder is long, stalactiform masses of manure are formed and hang like icicles over the milking pail, and make actual play on the back of the milker's hand while he is operating. This is no fanciful picture; it can be seen in not a few byres even as early as November, when through the use of fresh roots and their leaves the droppings of the cows are unduly fluid. In this connection it is well for the consumer that what the eye does not see the heart does not grieve over, and here I am tempted to relate an episode that illustrates the general complacency of the consumer in regard to the interest he takes in milk production.

A city girl of fourteen years was spending a day at a dairy farm where her school companion lived. For the first time in her life she witnessed the milking of the cows. They were none too clean, and when sitting at tea afterwards, she was sufficiently candid to tell her companion that she would rather have her milk supply from the nice clean pails in their dairy in the city than from the cows she saw in the byre that day.

Grading of Milk. Mr. Gofton is singularly, perhaps purposely, reticent on the thorny question of milk grading. As you are aware, the Ministry of Food have done a little under this head, and have set a standard for two grades—Certified Milk, and Grade A Milk—which are unobjectionable, excepting that few will attain their height until we have progressed considerably in the establishment of herds free from tuberculosis.

From what I know I would estimate that not more than 0·1% of our milk supplies can touch these standards, and therefore we are practically without any standard whereby we may differentiate between the qualities of milk produced in the great bulk of our herds. In practice, therefore, the consumer pays the same price for his supply whether it be produced under almost ideal or the most revolting conditions.

The public demand for Certified or Grade A milk is not very marked, and I know a grade A producer who has failed to find a market, and had to accept the same price as the common rut of milk producers. As one who has carried out much inspection of herds and premises, I think it would not be a difficult matter, by means of score cards, to separate into three additional grades the produce of our untested herds that cannot reach grade A, so that virtue may be rewarded and carelessness and neglect penalised. Bacterial examination of the milk would certainly be a useful handmaiden to the tangible evidence which the inspector finds at the farm in forming an estimate, but the prevailing conditions are sufficiently dissimilar on different premises for this further grading to be accomplished without recourse to microscopical work. Of course, the quality of the milk as to fatty and non-fatty solids would be taken into account.

My opinion is that the great majority of milk producers can only be influenced to adopt more perfect hygienic methods by threatening their pockets.

Let us have three additional grades, B, C, and D, and let grade C be that for which the controlled standard price is paid, and this would always be 3d. per gallon less than grade A. Grade B would then include a quality of milk equal in all the conditions of its production to those of grade A, excepting that the cows would not be tubercle-free, and let it be paid for at 1d. per gallon above the flat rate of grade C. Under grade D, I would place the supplies of all distinctly inferior premises, and have it paid for at 2d. per gallon less than the standard rate.

The adoption of such a plan would yield some protection to the consumer, and by its different stages of attainment and value would provide the only effective incentive for the producer to carry out those little details of improvement to byres and in their methods that would justify the inspector in lifting them into a higher grade. I do not think that this arrangement would operate to reduce milk production, and it would be an inspector's duty to indicate to grade D producers the lines along which improvement could be carried so that they might reach a higher grade.

If rational progress is to be made without undertaking revolutionary methods that are calculated to paralyse the milk industry, something like what I have indicated must be done. And as it is work pregnant with responsibility it must be put into the hands of men of independent position, so that they make firm decisions without fear; they must be experienced, fair-minded, and tactful in their work, that they may carry the confidence of stockowners; and the very nature of the duty compels me to say that none but veterinary surgeons can competently undertake it. The milk producer will not tolerate the noodle who would bully and drive him into the expense of alterations in surroundings, equipment and methods that are not based on the sound reasoning of a persuasive, educated, and tactful individual. And if this important duty is to be our own, the teaching of hygiene must be speedily extended, so that the student may have a broader understanding of sanitary science and building construction, and be able to give convincing advice, not only in regard to the health, feeding and handling of the animals and their produce, but also to indicate how existing premises may be altered at the least outlay so that the best possible results may be obtained in the attempt to avoid undue bacterial contamination of milk. If we be but true to ourselves in this connection, the veterinary profession will prove itself the very salt of the earth in the accomplishment of purer and more wholesome milk supplies.

(*To be concluded.*)

East and West Suffolk Veterinary Inspectors Association.

The annual meeting was held on Saturday afternoon, 7th inst., at Stowmarket, Mr. F. Morton Wallis (chairman) presiding over a large number of members. A scale of fees was drawn up for the consideration of the Executive Committee of the County Councils, and various details of the technical side of the work were discussed.

Office bearers for the ensuing year:—Chairman, Mr. H. L. Roberts, Ipswich; Vice-Chairman, Mr. T. J. Faithfull, Sudbury; Executive Committee, Messrs. J. R. Godbold, T. J. Faithfull, Philip Turner, Henry Phillips, and Charles Nesling. Mr. E. A. Hudson, Barrow near Bury St. Edmunds, was unanimously elected Hon. Secretary and Treasurer.

TREATMENT OF MANGE IN THE CAMEL.

To the Editor of The Veterinary Record

Sir,—In your issue of Aug. 8th, there appears a letter from Mr. Lornie having reference to my remarks concerning the treatment of mange in the camel as practised in Egypt.

I am grateful to Mr. Lornie for bringing this matter up as it gives me an opportunity of disclaiming any attempt to minimise his excellent work in this connection. No one who had the opportunity, as I had, of witnessing the extremely ingenious method adopted at Kantara for carrying out the gas method of treating mange, will deny that great credit is due to Mr. Lornie for his thorough and painstaking efforts.

I was shown a camel that was subjected to this treatment and examined him immediately he came out from the bath. His skin was not as damp as one would have expected (steam and SO_2 were passed into the chamber simultaneously), and his skin temperature was very little higher than when he went in.

I understand that the success of the treatment depends on the chemical combination of the SO_2 and steam, so forming Sulphurous acid. That this acid was formed I have no doubt. The camel was allowed to stay in for about twenty minutes and was then taken out. As far as I can remember, Mr. Lornie informed me that usually three immersions were sufficient for a cure.

Sulphurous acid is well known to be a very unstable acid, and I cannot think that it remains as such when the subject is brought into the air again where, evaporation taking place, the instability of the sulphurous acid would, I think, be well demonstrated.

If this be the case, it would therefore appear that all the good accruing from the treatment must, of necessity, take place while the animal is in the chamber.

My remarks concerning the inefficacy of this treatment were based on my examination of animals alleged to have been cured (horses), as regards camels, to information received from Mr. S. Rabagliati, late Officer Commanding Camel Hospital, Zeitoun, who accompanied me on my visit to Kantara.

I am somewhat astonished that, in view of the fact that Mr. Lornie has found this method so satisfactory, that the heads of the veterinary department, to whom Mr. Lornie's reports would have been sent, did not instruct that this be adopted elsewhere, especially at Zeitoun where there were hundreds of such cases (many of which came from Kantara), and which were treated, until I left in July, 1919, by means of sulphur and oil.

It would appear that Mr. Lornie has much useful information on this matter, and I hope he will consider the advantage of publishing his data.

With apologies for taking up so much of your space and thanking you in anticipation for inserting this letter,—I am, Sir, Yours truly,

GEO. W. DUNKIN, M.R.C.V.S., D.V.H.,

The Paddock, Upper Chantry Lane,
Canterbury, Aug. 17.

CANVASSING—BY PROXY.

Sir,—Is a veterinary surgeon responsible for the acts of his relatives as regards canvassing?

For instance, supposing his mother writes to the clients of other M.R.C.V.S. asking them to give her son "a turn." It strikes me as being very near the border-line of "unprofessional conduct," if not actually over it.—Yours truly,

"RICARDO."

OVERSTOCKING—
DOES IT CONSTITUTE CRUELTY?

This query arose in my mind to-day on visiting Newport, I.O.W. cattle market, where tethered for sale were twenty or more Guernsey cows with calves. The latter were secured and unable to suck had they so desired. Many of the cows were obviously overstocked, some with milk dripping from their teats, and from others directed in a steady stream on to the ground; the udders were distended and the teats pointing. Diverse opinions having been expressed with regard to this condition in cows, in actions brought for cruelty from time to time led me to carefully observe for some time each individual animal to see if I could detect any evidence of suffering.

Not one appeared to suffer even the least inconvenience or uneasiness; all seemed most quiet and unconcerned, and without exception were chewing the cud.

F.R.C.V.S.

British Losses in Horses and Camels.

Some interesting statistics have just been compiled by the veterinary section of the Imperial War Museum, now at the Crystal Palace, which show the totals of the British Army animal casualities throughout the war. In comparison with the human casualties the figures seem remarkably low, for the total animal deaths throughout the war amount to less than 15 per cent. per year of the total number of animals on service. These are the lowest figures recorded in any campaign.

Actually 484,143 animals lost their lives, including 5,589 lost at sea through enemy action.

The following table, which is for all theatres of war except that of the Dardanelles (where 13,864 animals died) shows how these casualties were apportioned.

	Average annual strength.	Average number constantly sick.	Percentage sick on strength	Died, killed or destroyed.	Mortality % on annual strength.
1914	204628	31116	15·23	17637	20·64
1915	483134	50131	10·37	53220	11·01
1916	744410	74760	10·04	71847	9·65
1917	966840	110632	11·44	145475	15·04
1918	827506	86758	10·48	127800	18·52

Included in the above totals are 120,013 camels, of which 22,812 lost their lives on service. The mortality among the camels was very much higher than that among horses, although the latter were exposed to more danger from enemy action. In the last year of the war 86·52 per cent. of the camels used in Mesopotamia alone died.

Of the animals shipped across the sea only 1·06 per cent. lost their lives on the journey, sickness accounting for the greater proportion of these.

The veterinary section of the Crystal Palace Imperial War Museum shows graphically, by means of photographs, models, war relics, paintings, etc., exactly how the sick and wounded animals were cared for on the battlefield and in hospital. The department is housed in the south-west gallery.

MENTIONS.

The names of the following have been brought to notice by the Commander-in-Chief in India for valuable services in India in connexion with the operations against Afghanistan, 1919:—

* * * *

Gillett, Maj. (temp. Lt.-Col.) E. S., C.I.E., R.A.V.C.

ARMY VETERINARY SERVICE

Extracts from *London Gazette*

REGULAR FORCES. ROYAL ARMY VETERINARY CORPS.

WAR OFFICE, WHITEHALL, Aug. 4.

Temp. Capt. E. V. Hobbs (since relinquished commn.) to be actg. Maj. whilst holding appt. of D.A.D.V.S., from May 12 to July 11, 1919.

Aug. 10.

The follg. relinquish their commns. on completion of service:—Temp. Capt. D. S. Rabagliati, O.B.E. (July 25, 1919) and is granted rank of Maj. Temp. Capts. and retain rank of Capt.:—W. G. Bentham (May 20); M. Cahill (Nov. 28, 1919); R. Hayes (March 18, 1919); F. V. Heron (April 24); J. H. O. Jerrom (May 29); J. McCunn (May 20); J. H. B. Martin (Nov. 20, 1919); J. C. Miller. O.B.E. (May 5); J. Pugh (June 17); T. A. Shaw (May 23); W. Watt (June 8). Temp. Lt. T. L. Dunn (Aug. 16, 1919), and retains rank of Lt.

TERRITORIAL FORCE.

Aug 9.

Capt. W. R. Williams resigns his commn. (Aug. 10), and retains the rank of Capt.

Aug. 11.

Capt. A. Robb to be Maj., and is apptd. D.A.D.V.S. of a Divison (July 31).

Maj. E. W. Parks, O.B.E, T.D., resigns his commn. (Aug. 12), and is granted the rank of Lt.-Col. with permission to wear the prescribed uniform.

Aug. 12.

Capt. R. N. Lewis to be Maj. (June 17).

SPECIAL RESERVE OF OFFICERS.

Aug. 4.

Capt. W. Shipley relinquishes his commn. (April 1), and retains the rank of Capt.

OBITUARY.

Capt. J. CAMERON late R.A.V.C., Veterinary Officer, British East Africa.

Graduated Edin: May 1906.

Capt. Cameron who was son of Mr. J. Cameron M.R.C.V.S., Berwick-on-Tweed, died of Blackwater fever on 28th July. He was in practice with his father at Berwick. A keen yeoman, he trained regularly with the Lothian and Border Horse, with which he mobilised in 1914. A month later he was granted a commission in the Army Veterinary Corps and did four years service with the Egyptian Expeditionary Force. He commanded the Convalescent Horse Depot for two years, and thereafter was D.A.D.V.S. of a Cavalry Division. He was twice 'Mentioned in Dispatches.'

Capt. Cameron joined the Veterinary Staff of the East African Protectorate 15 months ago and has been supervising veterinary duties in Lumbwa district.

DISEASES OF ANIMALS ACTS 1894 TO 1914, SUMMARY OF RETURNS.

Period.		Rabies. Cases Confrmd: Dogs	Rabies. Cases Confrmd: Other Anmls	Anthrax: Out-breaks (a)	Anthrax: Animals.	Foot-and-Mouth Disease.: Out-breaks (a)	Foot-and-Mouth Disease.: Animals.	Glanders.†: Out-breaks (b)	Glanders.†: Animals.	Parasitic Mange.: Out-breaks (b)	Parasitic Mange.: Animals.	Sheep Scab. (b)	Swine Fever.: Out-breaks (a)	Swine Fever.: Slaughtered. *
GT. BRITAIN. Week ended Aug. 14				5	7		133			20	27	1	23	14
Corresponding week in	1919	2		6	8	1	163	1	2	50	80		53	23
	1918			4	4				1	48	81	1	30	21
	1917			3	4			1	1	26	36	2	30	15
Total for 33 weeks, 1920		4		266	320	69	8970	10	17	2961	4996	291	1377	515
Corresponding period in	1919	134	3	129	167	24	1478	18	45	3920	7899	218	1459	541
	1918			167	189			23	65	3368	6400	248	964	389
	1917			321	368			18	30	1825	3562	395	1959	715

(a Confirmed. (b) Reported by Local Authorities. † Counties affected, animals attacked :—
Board of Agriculture and Fisheries, Aug 17, 1920 Excluding outbreaks in army horses.

IRELAND. Week ended Aug. 14.		...	...	...	...			Outbreaks		6				
Corresponding Week in	1919 ...	...	...	...	...	...	...	1		1		2		3
	1918 ...	...	...	...	...	...	...			5				
	1917 ...	...	...	...	...	...	...	2		5		4		29
Total for 33 weeks, 1920		1	1	...	...	1	3	82		180		6		23
Corresponding period in	1919 ...	...	...	...	...	1	1	120		167		22		69
	1918 ...	2	2	...	...	...	...	86		198		17		57
	1917 ...	3	5	...	...	1	1	36		253		169		1031

Department of Agriculture and Technical Instruction for Ireland, (Veterinary Branch), Dublin, Aug. 16, 1920

NOTE.—The figures for the Current Year are approximate only. * As Diseased or Exposed to Infection.